UNITED STATES DEPARTMENT OF AGRICULTURE

SURVEY REPORT

BOISE RIVER WATERSHED

IDAHO

1950

(AGRICULTURE - OGDEN)

UNITED STATES DEPARTMENT OF AGRICULTURE

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SURVEY REPORT

On Program of

Runoff and Water Flow Retardation

and

Soil Erosion Prevention,

BOISE RIVER WATERSHED, IDAHO,

50

1950

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Prepared by

U.S. FOREST SERVICE,

WITH THE COOPERATION OF THE

SOIL CONSERVATION SERVICE

In compliance with
the Flood Control Act of June 22, 1936, 49 Stat. 1570, as supplemented by the Act of June 28, 1938, 52 Stat. 1215.

CONTENTS

SUMMARY

An investigation has been made of the Boise River watershed in southwestern Idaho. This revealed that depletion of the plant cover and deterioration of the soil mantle have resulted in serious flood and sediment damages. Placer mining has also contributed to those damages. Future damages are estimated at $491,000 annually.

A remedial program is therefore recommended which will reduce the present accelerated rates of runoff, erosion, and sediment production and thus materially lessen the property damage and other losses in the basin. It will stabilize the soil and benefit the water resource and irrigation developments upon which much of the economy of the watershed is dependent.

In addition, the program will provide certain conservation benefits including increased production of timber, additional forage for livestock and big game, and improved fishing.

The recommended program will increase the infiltration of rainfall and thus reduce surface runoff, soil erosion, and sediment production by restoring and maintaining the vegetative cover. Depleted areas will be restored by reseeding and planting, complemented by gully plugs and other similar soil stabilizing structures. Management of both timber and grazing lands will be intensified by providing additional technical services and assistance supplemented by the construction and maintenance of range fences, livestock watering, and other facilities needed to insure proper distribution of livestock.

Major livestock adjustments will be required on certain steep slopes on which maximum vegetative cover is needed to stabilize the loose granitic soils. On other depleted areas, livestock will be temporarily excluded to permit successful revegetation and restoration of forage values. Other livestock and big game adjustments will be made in order to keep grazing use in balance with sustained carrying capacity and to maintain watershed stability. Destruction of the vegetative cover and impairment of the productive capacity of the soil by range and forest fires will be reduced by providing additional fire fighting equipment and other facilities and by additional manpower for fire detection and suppression.

The protection afforded by the vegetal phases of the program will be complemented by upstream channel stabilization, bank protection, and diversions. The installation and maintenance of small flood detention and sediment dams, new flood channels or rectifications, sand traps, and other similar means will protect local areas of high damage while the vegetation is becoming established. Sediment production will be further reduced by the stabilization of road banks and the improvement of road drainage.

Necessary additional educational facilities, technical assistance, and direct aids will be made available to insure maximum adoption and proper maintenance of the recommended measures.

To assure full and continuing maintenance of the restorative work on certain critical lands it is recommended that they be publicly acquired.

The recommended program will cost approximately $4,624,000 for installation and about $173,000 thereafter for maintenance. Of this amount the Federal government's share is about $4,165,000 including about $475,000 for land purchase, during the installation period of 10 years, with an annual maintenance cost thereafter of about $153,000. Installation costs to state and local governments is about $263,000, with an annual maintenance cost thereafter of about $17,000. The cost to private interests is about $195,000[1/] for installation, with an annual maintenance cost thereafter of about $3,000.

The ratio of total evaluated benefits to total costs is 1.6:1.

It has been assumed that the current conservation programs of all Federal agencies operating in the watershed will continue at about their present rate during the installation period and that a portion of the needed work will be provided by these programs. The extent to which flood control needs will be met by these other programs has been taken into account and the program herein recommended includes only the intensification, acceleration and adaptation of certain activities under current programs plus additional measures not now regularly carried out in such programs all of which are necessary to complete a balanced runoff and waterflow retardation and erosion control program for the watershed.

1/ Labor, materials, land, equipment, rights-of-way, easements, and other forms of contributions are included as part of the local cost.

FLOOD SURVEY REPORT
BOISE RIVER WATERSHED, IDAHO

INTRODUCTION

This report has been prepared in compliance with the Flood Control Act of June 22, 1936, 49 Stat. 1570, Seventy-fourth Congress, as supplemented by the Act of June 28, 1938, 52 Stat. 1215, Seventy-fifth Congress, which is quoted in part, as follows: "The Secretary of Agriculture is authorized and directed to cause preliminary examinations and surveys for runoff and waterflow retardation and soil erosion prevention on the watersheds of...the Boise River, Idaho."

DESCRIPTION OF THE WATERSHED

Location and Topography

The Boise River, a tributary of the Snake River within the Columbia River drainage basin, drains about 2,646,000 acres in southwestern Idaho (map 1). About 366,000 acres are irrigated valley lands between 2,200 and 3,000 feet in elevation, 582,000 acres are low foothills averaging 3,500 feet in elevation, and the remaining 1,698,000 acres are mountainous averaging 5,800 feet in elevation and attaining elevations over 10,000 feet in the Sawtooth Mountains. The drainage basin is roughly rectangular, 115 miles long and 35 miles wide, drained from east to west by the Boise River and tributaries. The drainage pattern is palmate dendritic.

The flood plain of the Boise River is about 60 miles long and from 1/4 to 3 miles wide from the city of Boise to the Snake River. These bottom lands are surrounded by a series of gently sloping

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BOISE RIVER WATERSHED
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GENERAL MAP

SUBMITTED J.M.R. 1-12-48 DATE		APPROVED H.L.L. 1-13-48 DATE	
COMPILED B.F.T.		MAP NO. 1	APPENDIX NO.
TRACED B.F.T.			
CHECKED J.M.R.			

COMPILED AT INTERMOUNTAIN FOREST EXPERIMENT STATION, OGDEN, 1939; G.S., G.L.O. FOREST SERVICE, HIGHWAY SURVEYS & BUREAU OF REC. & OTHER SURVEYS BY B.F. THURMON & BY B.F. THURMOND & G.L. BALLINGER

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terraces. Foothills above the irrigated valley include the drainage of Indian, Fifteen Mile, Willow, and Dry Creeks, and several gulches in the vicinity of Boise.

Generally the mountainous watershed above the mouth of Moores Creek is highly dissected with deep V-shaped valleys having very narrow flood plains even along the main streams. Moores, Grimes, and Lime Creeks and Crooked and Bear Rivers are exceptions having broader valleys and rather gentle relief. Smith and Camas Prairies occupy relatively flat remnants of old basalt flows. The Sawtooth Range forms the eastern divide while other mountains separate the main tributaries of the Boise River.

Slopes steeper than 40 percent are found on about 75 percent of the mountainous area and on about 15 percent of the foothills. More than 25 percent of the watershed is made up of slopes which are steeper than 60 percent.

Geology, Soils, and Erosion

The headwaters of the Boise River traverse an extensive granitic formation, the middle reaches are capped with basalt, and the lower valley contains alluvium. In geologic times the granitic batholith eroded rapidly and was intricately dissected by a complex drainage pattern. The lower third of the Boise River watershed which was covered by the ancient Lake Payette became filled with sand and gravel.

The soil mantle is predominantly residual. Granitic soils which have formed in place make up 72 percent of the area. They are of coarse texture and loose structure and are generally highly erodible.

Recent alluvial soils occur on 15 percent of the area and are restricted to the narrow canyon bottoms and to the flood plain of the Boise River. The remaining 13 percent has formed from basalt and rhyolite. All soils reflect characteristics of the rock material from which they were derived, the influence of weathering, and the effects of land use.

Accelerated erosion is occurring to some degree on most soils and is associated with the kind and condition of the plant cover, the steepness of slope, and the type of soil. Moderate to severely accelerated erosion is found on 12 percent of the area, moderate erosion on 53 percent, slight erosion on 28 percent, and normal geologic or rock erosion on the remaining 7 percent of the area.

The upper reaches of stream channels of the mountain tributaries are generally steep, fairly stable, and have ample capacity for flood flows. Along their lower reaches bank cutting is active on many of the streams, especially where placer mining operations have dredged valleys. The lower reaches of stream channels which drain the foothills are generally so filled with sand that they lack capacity for flood flows.

Plant Cover

The mountainous part of the watershed is mostly timber covered while the foothills and uncultivated valley lands are generally covered with sagebrush. For the watershed as a whole, conifers cover about 38 percent of the area, sagebrush 29 percent, browse 7 percent, and grass or weeds 10 percent. Cultivated lands occupy 13

percent of the area and the remaining 3 percent is made up of urban areas, water surfaces, and miscellaneous.

A total of 94,000 acres of timberland was cut over or burned previous to 1940. Those burned and logged over areas have scant or disturbed litter on the ground, inadequate forest reproduction and in some cases a growth of brush with an inadequate understory of soil-binding herbaceous plants.

About 14,300 acres of mountain, foothill, and valley lands have burned over annually since 1940. On the more heavily grazed areas and burned over brush and grass lands, the perennial grasses and forbs have been practically or wholly replaced by annual grasses and weeds, chief of which is cheatgrass (downy chess) which because of its high inflammability has increased the fire hazard.

Climate and Stream Flow

A Pacific-type of climate gives the watershed wet winters and dry summers. The average temperature for the valley is 51°F. and 40°F. for the mountains. Average monthly temperatures range from 20°F. to 73°F. while daily temperatures vary from -30°F. to 121°F. between mountains and valleys (from winter to summer). The humidity during summer months averages 24 to 31 percent and has dropped to 4 percent. The average growing season varies from 80 days in the mountains to 170 days in the valleys.

Weather Bureau rain gages record about 10 inches in the valley annually and 30 inches in the mountains with extremes of 4 to 39 inches. Snow depths average about 8 feet at 7,500 feet elevation on April 1 with 38 inches water content; extreme depths of 11.5 feet

containing 62 inches of water were measured in 1943. About 70 percent of the precipitation falls during winter and spring, generally as snow in the mountains. General storms, usually in the fall or winter, have totaled about 5.6 inches in a 5-day period. Only three of these storms have produced flood stages in the main stem of the Boise River. Centers of high intensity occur during summer storms which may cause local floods. The maximum recorded intensity of rainfall at Boise is 4.0 inches per hour for 5 minutes and 1.0 inches in an hour. An intensity of 6.0 inches per hour for 5 minutes has been recorded near Idaho City during a summer storm which totaled 1.4 inches an hour.

Major streams in the drainage basin have high stages in spring and early summer and low flow for the rest of the year. About two-thirds of the average runoff of 1,800,000 acre feet annually is yielded during April, May, and June. About half of the annual precipitation appears as stream flow, largely as ground water flow from recharge by melting snow. Surface runoff may result from local summer storms of high intensity.

LAND AND WATER ECONOMY

Mining

Recorded history of the Boise River begins with its discovery by the Astorian Land Expedition in 1811. Only trappers and fur companies were active in the area until about 1854. When gold was discovered in the vicinity of what is now Idaho City, about 60,000 miners (twice the present population of the city of Boise) flocked to that area

during the mining boom of 1863-65. Around 1870, the boom subsided and Boise County was left with a population of only 3,800. The valleys of upper Moores and Grimes Creeks (known as Boise Basin) were placered by hand methods during the first 5 years and the richer areas were worked several times. After placer mining became less profitable, hydraulic mining of higher bench gravels was started. Placer mining by dredging has become the most important type of gold production in recent years, amounting to about $660,000, in 1938 from five large dredges. Small hydraulic and hand placers also operate intermittently. Approximately 15,000 acres are within patented mining claims. Several thousand acres of timberlands have been left as gravel wastes after dredging.

Forest Products

Of the 997,000 acres of forest lands within the watershed, about 361,000 acres or 36 percent are classed as commercial timberlands. At present there are approximately 244,000 acres or about 3.05 billion feet B.M. of mature commercial timber, although a large portion is inaccessible to present logging methods.

As early as 1862, several small sawmills were built in Boise Basin to supply lumber for mining camps. Following construction of the Barber Mill, near Boise, in 1906, and a railroad to Centerville in 1915, cutting operations reached a peak in the late twenties. About 1.5 billion feet B.M. of timber were cut before the mill was abandoned in 1935. Almost all of the commercial timber in the Boise Basin was cut during this period. At present only about 3,000 to 4,000 acres or some 15 million feet B.M. are being cut annually within

the watershed. Erosion on most of the 94,000 acres of cut-over and burned forest lands has been accelerated by the removal of the protective cover and litter. About 40,000 acres of cut-over and burned forest lands are not adequately restocked.

Grazing

Large numbers of range cattle were brought into the watershed around 1860 when feed was abundant in the foothills. Beginning in about 1880, large bands of sheep forced the cattle back into the rougher mountain ranges. This struggle for control of the range continued until creation of the Sawtooth Forest Reserve in 1905 which provided for the initiation of controls over livestock use on the national forest lands. Range use including that by big game reached a peak about 1900 and again in 1919 with an estimated 450,000 to 500,000 animal unit months of use followed by a sharp decline to about 217,000 animal unit months of use by 1947.

With the exception of the cultivated lands in the valley, the principal land use is the grazing of livestock. A few areas in the mountains are closed to such use and in the higher mountains some areas are not grazed or are used very lightly by domestic livestock because of the inaccessibility and inherently low forage production. Part of the watershed is used both for grazing and timber production.

Accelerated erosion now taking place on many of the range lands has been brought about by overgrazing of livestock and big game which has resulted in the depletion of the plant cover and trampling of the soil. Grazing has further contributed to the sediment problem through the use by livestock of steep slopes upon which the soil mantle of

loose, disintegrated granite is quite unstable once its protective cover is removed.

Irrigation

Agricultural development of Boise Valley started with the mining boom. In 1864 the first water rights for irrigation were established. Large scale developments followed the construction of the Union Pacific Railroad through the valley in 1883. The first canals to irrigate the bench lands were built in 1888. Diversion Dam was completed in 1908, Deer Flat Reservoir (177,150 acre feet) in 1910, Arrowrock Reservoir (291,600 acre feet) in 1915, and Anderson Ranch Reservoir (500,000 acre feet), a multiple-purpose project, is now nearing completion. The acreage irrigated from the Boise River is about 340,000 acres of which about 150,000 acres within the Boise Project are dependent upon reservoir storage.

The economy of the basin is primarily agricultural and depends almost entirely upon irrigation for crop production. The 1946 sale value of irrigated cropland varied from $100 to $500 per acre and yielded an average annual gross income of about $86 per acre. The total investment in irrigation facilities, not including Anderson Ranch Reservoir under construction, averages about $52 per irrigated acre. The total investment in farm business within Boise, Ada, and Canyon Counties in 1945 was valued at $105,600,000 with farm products valued at $29,000,000.

Population

The growth of population after the mining boom was not rapid until after 1900; the present population is estimated at 100,000

people. About 97 percent of the present population is located in the Boise Valley where most of the people are concentrated in urban areas. Many of these people live within the flood plains of the Boise River and tributary foothill streams

Land Ownership

The mountainous portion of the watershed contains approximately 1,698,000 acres of which about 82 percent is in the Boise and Sawtooth National Forests. About 5 percent is state and county land, 12 percent is privately owned, and the remaining 1 percent is in other Federal ownership.

The foothill area contains 582,000 acres of which about 39 percent is administered by the Bureau of Land Management. County and state lands total about 13 percent. Another 3 percent is comprised of national forest lands and military establishments. The remaining 45 percent is privately owned.

The Boise Valley lands, comprising about 366,000 acres, are 89 percent privately owned with the remaining 11 percent made up of state, county, and municipal lands, and other Federal ownership.

The ownership of the entire watershed is summarized in table 1:

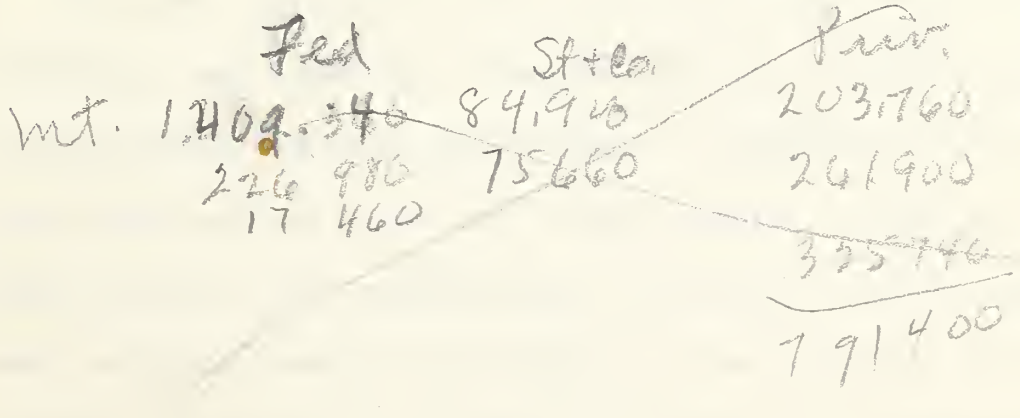

Table 1.--Land ownership, Boise River Watershed, 1947.

Classes of ownership	Acres	Acres	Percent
Federal government			
National forests	1,403,080		
Bureau of Land Management	228,990		
Other Federal	47,640		
		1,679,710	64
Other public			
State	150,940		
County	8,750		
Municipal	480		
		160,170	6
Private		805,810	30
TOTAL		2,645,690	100

Recreation and Wildlife

The forested mountains are a valuable recreational asset. Fishing in the mountain streams accounts for 34 percent of recreational use, hunting 15 percent, winter sports 8 percent, campers and other users 43 percent. In 1947 about 422,500 man-days of recreational use were reported by the Boise National Forest.

Big game population on the watershed is now estimated at about 10,000 deer and 3,200 elk. However, the total present grazing capacity available for these game animals is estimated to be adequate for only 6,000 deer and 1,300 elk. Concentration of deer upon the winter browse range in the foothills near the mouth of Moores Creek, Arrowrock, and Camas Prairie is a factor in the depletion of plant cover and the acceleration of erosion. Frequent and extensive fires in

these same areas have contributed to the destruction and depletion of forage on these winter ranges and have intensified flood and erosion problems. In other higher ranges on the South Fork of the Boise River, elk concentrate in damaging numbers.

The number of fish in the mountain streams has decreased steadily during recent years even though a stocking program has been carried out since 1917 by the Idaho Fish and Game Department and the Forest Service. Although some of this decline is attributed to heavy fishing of easily accessible streams, the heavy bed load of sediment and impairment of aquatic conditions by sediment deposits and erosion in streams draining depleted watershed areas has decreased pool structure, reduced food supplies, and destroyed or damaged natural spawning grounds.

Transportation

The principal highways traversing the Boise Valley are U. S. 30 and 95. The Union Pacific Railroad also serves Boise and other valley towns. Throughout the valley a network of paved and gravel-surfaced state and county roads form an intricate farm-to-market system. The mountainous portion of the watershed is crossed by a system of state, county, and Forest Service roads totaling about 1,500 miles. Many of these roads are subject to damage by accelerated runoff and, where inadequately drained and stabilized, are a source of sediment. Bank cutting along roads traversing tributary streams commonly occurs during floods.

WATERSHED CONDITIONS

Historical References

No better picture could be drawn of the watershed in its original condition than the accounts of early explorers. A description of the Boise Valley is given in the journal of Captain John C. Fremont, who on October 7, 1843, wrote, "We came suddenly in sight of the broad green line of the valley of the Riviere Boisee' (Wooded river)... which is a beautiful rapid stream, with clear mountain water, and, as the name indicates, well wooded with some varieties of timber--among which are handsome cottonwoods. Such a stream had become quite a novelty in this country"--(referring to the Snake River Plains to the south).

An even earlier reference is made by Washington Irving in recounting Captain Bonneville's journal of April 26, 1833: "The country about the Boisee' River is extolled by Captain Bonneville as the most enchanting he had seen in the far West; presenting the mingled grandeur and beauty of mountain and plain; of bright running streams and vast grassy meadows waving to the breese."

The change in the appearance of the region before the end of the century has been related by later technical writers. I. C. Russell of the U. S. Geological Survey described erosion observed during the summer of 1901 on the Snake River Plains: "A recent change has occured which has caused fresh stream channels to appear in previous streamless depressions, gulches, etc., and even on hillsides formerly completely soil covered. The change referred to is well known to ranchers and others and is said to have begun about 1880....."

"One conspicuous result of the more complete drainage of valley bottoms by modern rill channels is the dying out of formerly luxuriant meadows of wild grasses and their replacement by sagebrush. The rapid erosion in progress is destroying much of the finest land in the mountain valleys lying north of the Snake River Plains, and its prevention is an exceedingly important problem, which demands immediate attention."

Present Conditions

Today, by contrast to the early picture, a muddy river choked with sand bars runs through the Boise Valley below sagebrush and cheatgrass hills and forested mountains. A recent survey classed about 2 percent of the mountains and foothills as high sources of sediment, 13 percent as moderately high sources, and 51 percent as moderate sources, leaving only about 34 percent of the area relatively undisturbed by past use of the watershed.

About 70 to 90 acre feet of sand have been measured moving down the Boise River near Diversion Dam in normal years and up to 50 acre feet carried into New York Canal. It is estimated that about 90 acre feet of sand is removed from canals and laterals each year. As much as 60 acre feet of sediment is carried by the Boise River annually at Twin Springs and up to 80 acre feet into the Snake River at Notus. Arrowrock Reservoir has lost about 7,700 acre feet of capacity since 1915 in spite of sluicing. Diversion and Barber Ponds are completely filled with sand. The main channel of the river is choked with an estimated 3,200 acres of sand bars. Cross-sections

surveyed over a period of years show that the capacity of the main channel changes year by year as sand bars move downstream.

In 1939 and 1940 stream gaging and sediment sampling was conducted by the U. S. Geological Survey to determine the runoff and sediment characteristics of small forest and range watersheds. Three drainages were selected representative of burned, cut-over, and mature undamaged forests and three typical of moderate to severely overgrazed range. A comparison of these records is given in table 2:

Table 2.--Peak flows and sediment loads, tributaries of Boise River, 1939-40.

Tributary	Drainage Area (acres)	Cover Condition	Source Area[1] (percent)	Peak Flow 1939 (cfs/sqmi.)	Peak Flow 1940 (cfs/sqmi.)	Sediment 1939 (tons/sq.mi.)	Sediment 1940 (tons/sq.mi.)
Bannock Creek	2,880	Mature forest	1.4	0.9	5.1	3	162
Pine Creek	4,160	Cut-over forest	4.5	2.0	4.8	96	1,200[2]
Granite Creek	3,070	Partly cut-over & burned forest	25.6	1.7	4.4	610	405
Cottonwood Creek	13,700	Moderately grazed range	34.2	2.8	4.5	33	377
Cottonwood Gulch	10,240	Overgrazed range	81.3	3.9	3.9	1,550	940
Grouse Creek	5,120	Seriously overgrazed range	63.0	11.1	4.9*	3,450	2,490

1/ Percent of area contributing above average sediment and runoff.
2/ Affected by placer mining.

When these discharge and sediment load observations were related to the cover conditions on the small watersheds, the relative rates of sediment production due to land use were as indicated by table 3. It is therefore evident that land use has increased the sediment production from local abused areas, especially in the rangelands which are overgrazed. The need for and probable effect of watershed improvement measures can be seen in the comparison shown by table 3:

Table 3.--Relative sediment production for cover conditions.

	Cover Condition 1/			
	Good	Fair	Poor	Bare
Mature forest	1	1	3	-
Cut-over or burned forest	-	2.5	8	-
Mountain browse	1	2	5	-
Sagebrush	-	5	8	10
Herbaceous	-	5	12	30

1/ Relative sediment production rate compared to good forest or browse as unity.

Suspended sediment load measurements were also made above and below a dredged basin near Idaho City. The total load for the period was greater below active placer mining. Most of the additional suspended load was fine material from active dredging carried by the stream during high water in the spring of 1940. This increase is about twice the load of Upper Moores Creek above the basin, as shown by table 4:

Table 4.--Sediment loads from placer mining, Moores Creek, 1939-40.

Tributary	Sediment Load (tons)
Upper Moores Creek (forested headwaters)	11,300
Other creeks (some are placer mined)	28,600
Moores Creek above basin	39,900
Moores Creek below basin	60,800
Placer mining contribution	20,900

FLOOD AND SEDIMENT DAMAGES

Flood History

The highest stages on the Boise River each year have occurred in the spring from March to June. The Middle and North Forks have generally contributed about 50 percent of the peak flow and South Fork about 40 percent. Moores Creek generally peaks from 1 to 10 weeks earlier; the other main forks of the Boise River usually peak within a few days of the maximum flow at Diversion Dam. The occurrence of flood stages is related closely to sustained rises in temperature during the snow melt period. On three occasions, however, the Boise River has attained low flood stages after general storms in the fall; in small tributaries, floods are also caused by summer cloudbursts.

Flood stages have been recorded near Diversion Dam on the Boise River since 1895 while stages back to 1865 have been estimated from climatic records at Boise. Regulation by the authorized Lucky Peak Dam would have controlled all except two floods in the past 50 years

within the present channel capacity of 6,500 second feet. A list of some of the major estimated and recorded floods is shown in table 5:

Table 5. Major floods on the Boise River, 1865-1946.

Estimated peak flow		Recorded peak flow	
Date	Max. daily discharge	Date	Max. daily discharge
	(cfs)		(cfs)
May 28, 1871	43,000	June 14, 1896	35,500
May 20, 1872	50,000	Apr. 19, 1897	29,500
May 25, 1874	36,000	May 18, 1927	20,060
Apr. 18, 1875	26,000	May 10, 1928	20,710
Apr. 20, 1881	29,600	Apr. 18, 1943	25,040
Apr. 24, 1894	35,000		

Local floods occur after intense summer storms or from melting snow in the spring. In the foothills and especially within the city of Boise, these floods are a local problem. Since 1871 newspapers have reported 31 floods from gulches draining through Boise. About half of these floods were caused by rain storms. Other foothill streams which cause primarily agricultural damage include Dry, Willow, and Indian Creeks. A summary of floods within the city of Boise is shown in table 6:

Table 6.--Floods in the city of Boise, 1871-1947.

Floods from Rainstorms	Flood Stage	Floods from Snow Melt	Flood Stage
July 10, 1874	Low	March 30, 1871	Low
July 20, 1874	Low	Feb. 3, 1881	Low
April 21, 1881	Low	March 5, 1881	Medium
May 6, 1890	Low	March 28, 1881	Low
May 28, 1890	Low	March 16, 1890	Low
May 20, 1891	High	March 19, 1893	Medium
May 9, 1896	Low	March 31, 1893	Medium
April 21, 1904	Low	March 19, 1894	Medium
June 20, 1909	High	March 26, 1897	Low
July 25, 1913	High	March 9, 1904	Low
April 29, 1917	Low	March 29, 1904	Low
July 14, 1923	Medium	March 11, 1905	Low
June 2, 1925	Low	Feb. 7, 1907	Medium
July 23, 1925	Low	March 4, 1910	Low
		Feb. 10, 1924	Low
		March 5, 1929	Low
		March 20, 1932	Low

Flood Damages

The Boise River in flood stage inundates agricultural lands and urban communities within the flood plain in the Boise River Valley. The Corps of Engineers has estimated that flood and sediment damages resulting from flood flows in the main stream average $805,100 annually based on 1944 developments and 1940 prices. It is estimated by the Corps of Engineers that the Lucky Peak project when combined with existing levees and the flood control features of other existing reservoirs on the river will reduce the above damages along the main stem to about $166,800 annually. It will also control all except major infrequent floods of the Boise River to the present capacity of the channel.

Urban and rural developments along foothill streams are damaged seriously by local floods. Within the city of Boise these damages are greatest. Here floods still remain uncontrolled and are potentially a great hazard, since channels through town are poorly defined and choked with sand. Flood waters enter the residential section and flow over the streets and city lots flooding basements and depositing sand and debris. Farms are damaged by other flooding foothill streams. Sand is deposited in the lower reaches, aggrading the channels and spreading over valuable farm land, irrigation works are washed out or buried in sand, and crops are destroyed. Roads throughout the watershed are also damaged by local runoff and sediment deposits, thus requiring excessive maintenance. These local flood damages, including about $8,200 indirect damage to urban and foothill areas, are estimated to total $130,000 annually on the basis of 1947 prices. About 54 percent of the damage is to the city of Boise, 15 percent along other foothill streams, and 31 percent to roads throughout the watershed.

Sediment Damages

The irrigation system of storage reservoirs, diversion dams, canals, and laterals is damaged by sediment which increases cleaning costs of canals and laterals, reduces canal capacities, and depletes the storage capacity of reservoirs. Sediment is not only carried during floods, but is moved by normal flow down the river channel into canal diversions. The value of lost storage in reservoirs is estimated at $281,000 annually over a 100-year period. Sediment damage to canals and laterals, including water losses, is estimated at

$80,000 annually after Lucky Peak Dam is completed. Future sediment damages, are therefore, estimated to total $361,000 annually.

FLOOD CONTROL ACTIVITIES

Federal Agencies

No large-scale concerted efforts toward development or prosecution of a flood control plan had been undertaken in the watershed prior to the enactment of the Flood Control Act of June 22, 1936, and until recently no comprehensive plan for flood control had been developed. However, some improvements have been made by local interests and various agencies which affect the current need for flood control.

The Department of the Army through the Corps of Engineers have at present an authorized flood control project known as the Lucky Peak Reservoir located on the Boise River about 10 miles downstream from Arrowrock Dam. Levees and revetments were also reconstructed by the Corps of Engineers at many locations along the Boise River after the 1943 flood. These improvements will confine all except infrequent major floods within the present channel capacity of the Boise River.

The Department of Interior through the Bureau of Reclamation constructed Arrowrock Dam in 1916 to provide a reservoir for irrigation purposes; however, the operation of this reservoir has had limited flood control value. At present the Bureau of Reclamation is completing construction of the multiple-purpose Anderson Ranch Dam. This dam when completed and operated in conjunction with the Arrowrock and Lucky Peak Dams, will greatly reduce the existing

flood hazard in the lower reaches of the Boise River. The Bureau of Land Management administers 229,000 acres of foothill lands. Current activities include organized fire control and a planned soil and moisture conservation program under which a small amount of work has been done. Present expenditures are largely limited to maintenance of existing improvements.

The Department of Agriculture through the Forest Service administers 1,403,000 acres of Federal lands. The Sawtooth National Forest established in 1907 and the Boise National Forest established in 1908 were created from lands set aside in 1905 as the Sawtooth Forest Reserve. These national forests were established for the primary purpose of promoting watershed protection, and management of these lands has included control of fire, destructive insects, and regulation of livestock use and logging operations. Current activities also include range reseeding, range fences, water developments, and check dams. In 1935 the National Forest Reservation Commission approved a purchase unit which included lands draining into Arrowrock Reservoir. Subsequent action has enlarged the purchase unit to include parts of Moores Creek drainage. The principal purpose of this action was to provide for public acquisition of certain critically depleted privately owned lands as a means of halting misuse and to apply restorative measures which private land owners could not afford. Purchase authorization now includes 157,087 acres. Acquisition of the more critical of these lands is now progressing at a rate of about 1,500 acres annually. Current

expenditures by the Department of Agriculture for measures having a substantial effect on flood and sediment control are estimated at $93,000 annually on Federal lands.

The Department of Agriculture also provides financial and technical assistance to the owners and operators of state, county, and private lands. The Soil Conservation Service furnishes technical assistance to the two soil conservation districts in the watershed. The Production and Marketing Administration shares in the costs of installing conservation improvements. The Agricultural Extension Service promotes improved land use practices and emphasizes the influence of proper practices on flood control. The Forest Service cooperates with the state in fire control activities on non-Federal lands. The total expenditure by the Department of Agriculture in the watershed for education, technical assistance, fire control, the installation of fences, water developments, check dams, water diversions, and for range reseeding and similar measures having a substantial effect on flood and sediment control is estimated to be $55,000 annually on non-Federal lands.

State and Local

In 1937 the state of Idaho passed a flood control district law which permits organization of districts for cooperation with the Federal government. The Works Progress Administration, in cooperation with the cities of Boise, Nampa, and Caldwell, and the counties of Ada and Canyon, installed channel improvements in reaches of Boise

River and lower Indian Creek at a cost of about $250,000. Channel work in Ada and Canyon counties has included straightening, enlarging, and installation of revetments and dikes at an estimated cost of $67,000. In 1939-40 the State Department of Forestry planted 516,000 coniferous trees on the Boise River watershed and 21,000 black locusts on the hills north of the city of Boise.

The State Fish and Game Commission has recognized the problems created by excessive concentrations of deer and elk and has adjusted hunting regulations in an effort to keep big game populations in balance with watershed, recreational, and other values. Some preliminary attention has also been given to the public acquisition and restoration of critically depleted winter deer range.

The city of Boise has constructed small impounding dams on several gulches and has lined channels through the city to the Boise River. At present, the impounding areas behind the dams are filled with sediment, and the existing channel capacities, varying from 35 to 210 second feet, are grossly inadequate. An estimated $5,000 has been spent annually in improving these drainages. About $3,500 has been spent in building levees on Dry Creek.

Existing Problems

The survey revealed that, notwithstanding past efforts of Federal, state, and local interests, further improvements are needed to:

1. Reduce sediment damage to irrigation system of reservoirs, diversions, canals, and laterals.
2. Protect the city of Boise and other developments along foothill streams and roads throughout the watershed from flood and sediment damages from local floods.

3. Improve the vegetative cover on the watershed lands to control erosion, reduce surface runoff, and restore the range, timber, and wildlife resources.

RECOMMENDED REMEDIAL PROGRAM

Remedial Measures

The analysis of the flood and sediment problem and the conditions directly responsible indicate the necessity for a remedial program. This program must take into consideration the opportunities for land treatment and complementary structures. In developing the program all physical features favorable to the restoration and retention of an adequate vegetal cover were considered as well as complementary structural measures. The latter were necessary to stabilize soil conditions so as to permit vegetation to become established, to afford immediate reduction of flood and sediment damages while the land treatment program was becoming effective, and to reduce sediment damages arising from placer mining operations. The complementary structural program is particularly important where destructive floods and high sediment production are expected to continue during the restorative period. In such cases measures are recommended which will afford relief from flood and sediment damages as soon as they are completed. Many stream channels now contain heavy bed loads of coarse sediment resulting from years of unwise watershed use. These sediment loads are gradually moving downstream and certain of the structural measures are needed to reduce the excessive amounts of sediment now entering the stream channels and irrigation works.

The program is therefore integrated not only on the basis of physical and biologic characteristics of the watershed but also on the needs of the basin for immediate protection from flood damages. It will also provide many other concomitant conservation and indirect benefits.

The remedial measures proposed are expressed in approximate quantities derived for cost estimating purposes only. The estimated quantities are over and above that which is estimated to be accomplished under going programs of all Federal agencies during the installation period. The costs, which include maintenance during an estimated 10-year installation period, are based on 1947 prices.

The adjustment of grazing use by livestock and big game so as to permit restoration and maintenance of an adequate vegetal cover is prerequisite to other measures. To facilitate early restoration of an adequate vegetal cover it will be necessary to undertake temporary exclusion of livestock from areas totaling about 236,000 acres. Exclusions will be staggered over a 10-year period. On an additional area of foothill land estimated to be less than 18,000 acres, major livestock adjustments will be applied and big game managed so as to prevent damaging concentrations. These latter lands are made up of steep slopes mostly in excess of 60 percent. If the accelerated sediment production from them is to be controlled, grazing use must be reduced to a level which will permit successful restoration and continued maintenance of plant cover and soil stability. On the remaining range areas, moderate adjustments in present use will be necessary to permit the present insufficient cover to recuperate. Thereafter, grazing use on all range lands will need to be managed on the basis of sustained carrying capacity so that satisfactory watershed conditions will be maintained.

To achieve proper management and distribution of livestock use will require about 144 miles of range fences and 8 livestock watering developments, which may involve the purchase of some local water rights or the right to use water. The cost of installing these measures and of maintaining them during the initial period will be about $133,000.

Reseeding of critically depleted areas to desirable perennial grasses so as to check erosion and runoff is needed on about 68,130 acres at a cost of $409,000. The planting of shrubs on about 4,900 acres of very steep slopes which are now eroding actively will cost about $98,000. The planting of trees on certain timber lands now insufficiently stocked to control erosion and retard snow melt may be needed.

Gully erosion and stream bank cutting will be arrested by the installation of some 2,216 small structures such as gully plugs, about 21,590 linear feet of diversion ditches, about 2,230 linear feet of bank protection, shrub and tree planting along about 200 miles of channels and 720 miles of small gullies, and by other similar soil stabilization measures. The cost of installing and maintaining these measures during the initial period will be about $203,000.

It will be necessary to construct about 120 miles of work roads to provide access to parts of the watershed for the installation of the other program measures. The cost of these roads including maintenance during the installation period is about $43,000.

In order to more adequately protect the cover on the watershed lands from fires which often burn over extensive areas especially

during the recurring dry summers, additional fire control measures will be installed and maintained on about 1,403,000 acres of Federally owned land, and 180,000 acres of non-Federally owned lands within the national forest boundaries. These measures will consist of additional equipment, buildings, and technical supervision needed during dry years to obtain the degree of control now being achieved during normal seasons. On the remainder of the watershed, largely foothill and valley lands of which 229,000 acres are Federally owned and 418,700 acres are under state and private ownership, present fire fighting facilities are inadequate. For these areas the program includes such things as additional equipment, buildings, and fire detection and suppression personnel. These measures will reduce the number of fires and prevent large fires which now result from the inadequate control measures available. The cost of installing these fire control measures including that of maintaining them during the initial period is about $426,000.

Other measures which will complement the restorative measures by reducing flood and sediment damages while the vegetative program is becoming effective include about 16 small flood detention dams and sediment control basins at a cost of about $758,000. Because of the great amount of sediment already in the channels the program also recommends the installation of about 23 sand traps in the larger irrigation canals at a cost of about $292,000. Additional protection against local floods will be provided by about 60,500 linear feet of channel rectification and about 26,500 feet of new flood channels. The cost of these supplementary measures will be about $458,000.

Approximately 6,700 drainage structures of a minor nature, 5 miles of revetments, 11 miles of ditches, and 220 miles of bank stabilization on roads will aid in reducing runoff and in checking erosion at a cost of about $754,000. In addition to other benefits these road improvement measures will reduce present maintenance costs.

A facilitating measure for the successful installation and proper maintenance of the program is the acquisition of an estimated 83,000 acres of private watershed lands most seriously damaged by fire and continued overgrazing. The purchase cost of these lands, including the expense of acquiring them and of management during the initial period, is about $475,000. While these critical lands are for the most part included in the authorized national forest purchase unit, their acquisition as a part of the flood control program is recommended so that the installation and operation of restorative measures on them can be integrated with other parts of the program. About 30,000 acres of these lands are outside but mostly adjacent to the Boise National Forest and extension of the present boundary of the forest is recommended where this becomes necessary to facilitate Federal ownership. As these lands should be retired from all grazing use they can provide little financial return to the private owners. In addition most of them have already deteriorated to such an extent that private owners cannot afford to either install or maintain the measures necessary to reduce the flood water and sediment which originates on them.

There is need for additional manpower to provide more adequate protection and management of Federal lands including those to be

acquired. This additional technical service is needed especially in the lands to be improved under the physical program recommended. Technical assistance in an amount above that presently available will be provided for timber harvesting operations on privately owned lands in the watershed. This will insure that future logging operations on these lands will be conducted with minimum disturbance of watershed cover and maximum assurance of satisfactory restocking of desirable timber species. Additional technicians are also needed to assist and advise other private land owners involved in the recommended program. The cost of such additional manpower, which will be made available in accordance with practices authorized under current legislation, is about $528,000 during the initial period. During the installation period there will be a need for the cooperative integration of the various parts of the program at a cost of about $40,000, or a total cost of $568,000 for technical services and assistance.

A consolidation of state land holdings in order to achieve better land management and administration of critical areas also appears highly desirable.

Program Costs

The total installation cost of the recommended program, shown in table 7, is about $4,624,000. The cost is $4,165,000 to the Federal government, $264,000 to state and local governments, and $195,000 to private interests.

Table 7.--Estimated costs for installation of program 1/

Over-all treatment measures	Total
Watershed treatment	$1,319,000
Structural works	2,262,000
Technical services and assistance	568,000
Land acquisition	475,000
Total	$4,624,000

1/ Includes cost of maintaining measures during the installation period.

It is anticipated that the recommended measures for non-Federal land will be installed under cooperative arrangements with agencies acceptable to the Secretary of Agriculture. Local interests are to be required to furnish without cost to the United States all requisite rights-of-way and easements on non-Federal lands, and hold and save the United States free from all claims for damage incident to the construction and operation of the recommended program for flood control.

The recommended measures will be installed on Federally owned or administered land under arrangements between the Secretary of Agriculture and officials responsible for the administration of the land. This will provide for the coordination and integration of the measures to be installed on such land with those to be carried out on other land within the watershed. Water rights or rights to the use of water will be acquired in accordance with existing state laws. The Secretary of Agriculture may construct such buildings and other improvements as are needed to carry out the measures included in the recommended program.

In preparing the recommended program and in developing the measures necessary to achieve the benefits claimed, it has been assumed that all pertinent and related activities currently in progress in the watershed will be continued on about their present scale inasmuch as the program recommended is over and above all current work. In carrying out the program, it is proposed to take full advantage of opportunities to utilize the services of the various conservation agencies, locally in the state as well as those in the U. S.

Department of Agriculture and other Federal departments.

The authority of the Secretary of Agriculture to prosecute the recommended program shall be supplemental to all other authority vested in him, and nothing in this report shall be construed to limit the exercise of powers heretofore or hereafter conferred on him by law to carry out any of the measures described herein or any other measures that are similar or related to the measures described herein.

It is believed that only through the measures and practices recommended for the watershed can widespread and beneficial water-flow retardation and soil erosion prevention be achieved. However, the Secretary of Agriculture may make such modifications or substitutions of the measures described herein as may be deemed advisable due to changed physical or economic conditions or improved techniques whenever he determines that such action will be in furtherance of the objectives of the recommended program.

Maintenance of Program

The lands will need to be managed not only to bring about restoration of vegetal cover, but also to preserve their beneficial watershed values. Complementary measures will also need to be maintained so that the benefits which they contribute will continue until the restorative measures on the watershed become fully effective in reducing flood or sediment damages.

Included in this necessary maintenance of the recommended program measures are such things as additional technical services and assistance to insure improved management of range and forest land. Fire control will need to be carried out each year and provision be

made for the emergency treatment of burned areas to prevent accelerated erosion. Range fences, work roads, water developments, and other aids to the restorative program must be kept in proper repair. Flood and sediment dams, channel improvements, and sand traps in irrigation canals will need to be maintained in operating condition. Administration for flood control purposes of the lands to be acquired is provided.

Annual maintenance costs of the program total $173,000. The cost is $153,000 to the Federal government, $17,000 to state and local governments, and $3,000 to private interests. A summary of total annual maintenance charges is shown in table 8.

Table 8.--Estimated annual costs for maintenance of program.

	Total
Watershed treatment	$104,000
Structural works	25,000
Technical services and assistance	34,000
Land acquisition	10,000
Total	$173,000

Participation in Program

The burden of initiation, completion, and maintenance of the various features of the recommended flood control program will be borne in large measure by the Federal government. Assistance will be obtained, however, from state, county, and city governments, state soil conservation districts, local communities, irrigation companies, and from private owners and operators. In view of the Federal aids proposed, the widespread interest in the program, and the fact that the affected individuals are users of the public lands, it has been assumed that all of the affected land owners and operators will participate in its installation and maintenance. It is anticipated that about 10 years will be required to install the recommended program.

Installation costs are allocated on the basis of public benefits to be derived from the measures. The Federal government will pay the cost of all measures installed on Federally owned land and lands in the process of being acquired, acquisition of critical land, program integration, all technical assistance and services required to install the program excepting that ordinarily provided by the Agricultural Extension Service, up to 90 percent of the structural measures applied on non-Federal lands, and up to 50 percent of all other measures applied on non-Federal lands including assistance ordinarily provided by the Agricultural Extension Service.

The balance of the costs for measures on non-Federal lands will be borne by non-Federal interests.

Annual maintenance will be allocated as follows: the Federal government will intensify protection and management of Federal lands and provide technical assistance to non-Federal lands in connection with the intensification and acceleration of the programs of the Soil Conservation Service and the Agricultural Conservation Program of the Production and Marketing Administration, will continue cooperative activities to assure integration and proper upkeep of the program, especially on non-Federal lands, and will provide the necessary maintenance to the various measures and structures on Federal lands. In addition, the Federal government will assume up to one-half of the annual maintenance for structural measures on non-Federal lands where these measures are an integral part of the program on Federal lands, up to one-half the annual maintenance for fire control on non-Federal lands, and up to one-half of the educational and technical services ordinarily

provided by the Agricultural Extension Service. Local agencies will provide the balance of maintenance required on these measures and complete maintenance for all other measures on lands in non-Federal ownership.

PROGRAM BENEFITS

The combined effects of all the measures when fully established will, in most instances, reduce peak flows from summer storms below flood proportions. The damages to urban and rural developments in the foothills resulting from local floods on tributary streams will be reduced by about 90 percent. It is estimated that the loss of reservoir storage capacity through sedimentation will be reduced by about 38 percent and that sediment deposition in the irrigation distribution system will be reduced about 94 percent. Flood and sediment damage to roads which now cause high maintenance costs will be reduced about 84 percent. The present cost of fire suppression will be reduced.

Other beneficial results will accrue from the program. The productivity of the range and of depleted timber lands will be enhanced and restored and more effective control of fire will prevent the destruction of existing commercial timber. The production of irrigated crops in the Boise Valley upon which much of the economy of the watershed depends will be safeguarded and perpetuated. The program will stabilize the number of deer and elk which can be harvested on a sustained yield basis, and the big game herds will be maintained at safe levels. Fishing will increase and favorable habitat for upland game birds will be enlarged. Other

recreational values will be greatly enhanced. The planting of trees and shrubs and certain modifications of timber cutting practices are expected to increase the beneficial deposition of snow and retard the rate of snowmelt on other areas with a corresponding reduction in spring peak flows on tributary streams.

Flood damages in the future are expected to increase unless a remedial watershed program is installed. Benefits are based on the difference between expected future damages with and without a program for a 50-year period. Benefits from the recommended program will total about $547,000 annually, of which those related to sediment reduction and water control are estimated at $271,000 annually. Many other benefits ascribable to the program cannot be readily evaluated in monetary terms. Most important of these are the public benefits which will result from restoration and maintenance of the soil mantle and protection of water resource.

A recapitulation of all estimated future annual benefits is shown in table 9:

Table 9.--Estimated annual value of future benefits of program.

Residential, municipal, business (Boise area)	$ 62,800
Agricultural (local tributaries)	11,700
Roads and highways	30,700
Reservoir sedimentation	96,800
Irrigation distribution system sedimentation	68,700
Reduced fire suppression	11,200
Recreation (hunting and fishing)	69,400
Range conservation	62,900
Timber conservation	132,800
Total benefits	$547,000

Because of biological limitations many of the restorative measures cannot become immediately effective and relief and protection from damages will at first be largely dependent upon some of the structural phases of the program. Therefore, in the early stages, maintenance costs to preserve maximum effectiveness of the channel works, flood and sediment dams and road improvements will be relatively high. As the remedial measures become increasingly operative, these costs will materially decrease and the effective life of channel works will be prolonged by reductions in runoff and sediment production due to the improved vegetal cover. In some areas the progress of vegetal controls will be accelerated by installing various complementary minor engineering measures, while in other areas vegetation will become effective within a short time after some of the measures and controls are established.

The integrated effect of all the measures will maintain the high degree of protection for which the program has been designed. The time period during which local protection will rely largely on the structural measures will depend on the condition of the tributary watershed. Some slopes have now so badly deteriorated that it will require many years to restore them to the point where reliance need not be placed on structures. Even after the watershed restorative measures become fully effective in checking accelerated sediment production from the land surfaces and smaller tributaries there will be sediment damages. The great bed load of sand and other coarse sediment which has developed from years of misuse and which is now in the lower reaches of the stream channels and moving into the irrigation distribution system will continue to move slowly downstream. Certain of the detention dams, flood channels, and sand traps will have to be maintained at full effectiveness until the damaging sediment deposits become stabilized or move gradually out of the watershed. However, the structures which are designed to stabilize existing large deposits of unstable placer materials resulting from earlier mining operations will prevent to only a small extent and for only a short time the flow of additional sediment due to current placer operations. More complete control of sediment will not occur until measures are instituted by local authorities for the prevention of sediment contributions to the streams from current placer mining.

The program as outlined therefore relies for its full effectiveness upon a series of integrated dependent measures which combine

to afford immediate as well as long time relief from flood and sediment damages in the basin.

COMPARISON OF BENEFITS AND COSTS OF PROGRAM

Benefit-cost ratios were computed upon the basis of average price relationships expected to prevail during the period 1955 to 1965. Prior to this section of the report all benefit and cost estimates have reflected prices in the watershed during 1947. The 1947 values were adjusted to reflect anticipated future average prices by means of price indexes. The standards used were: indexes of 150 (1910-14=100) for prices received by farmers, 165 (1910-14=100) for prices paid by farmers, 325 (1913=100) for construction costs, and 115 (1926=100) for lumber prices. A 2½ percent interest rate was used to convert Federal, state, and local installation costs to an average annual cost and a 4 percent interest rate was used to convert private installation costs to an average annual cost. On this basis the annual benefits total $359,000 and the annual costs of installation and maintenance total $226,000. The ratio of over-all benefits to costs is 1.6 to 1.

The recommended program is also justified because of the public welfare involved. Most of the flood and sediment areas are in Federal ownership. The condition of these public lands is such that the floods and sediments now originating on them threaten the social and economic life of the people who are dependent upon a continuation of the benefits these lands should afford.

RECOMMENDATIONS

It is recommended that the Federal government undertake the installation of a flood control program within the Boise River watershed to reduce surface runoff, erosion, and sediment production at a Federal cost of about $4,165,000 for installation and $153,000 annually for maintenance. The cost to state and local governments is about $263,000 for installation and $17,000 annually for maintenance. The cost to private interests is about $195,000 for installation and $3,000 annually for maintenance.

The program herein recommended includes the intensification, acceleration, or adaptation of certain activities under the current programs of Federal agencies in the watershed, and additional measures not now regularly carried out in such programs, all of which are necessary to complete a balanced runoff and waterflow retardation and erosion control program for the watershed. It is recommended that the Secretary of Agriculture be authorized to carry out all of this program except the part which is proposed for installation on land under the jurisdiction of a Federal agency other than the Department of Agriculture. It is further recommended that the head of such other Federal agency be authorized to carry out the part of the program which is proposed for installation on land under the jurisdiction of such agency. The extent to which the work recommended in this program for which the Secretary of Agriculture is to be responsible will be carried out under the Flood Control Act as requested herein or under other authorities will be considered by the Secretary in requesting appropriations for the prosecution of the program. Although

the current activities of Federal agencies in the watershed which are primarily related to the objectives of the Flood Control Act are not included in the program herein specifically recommended, the program is based on the continuation of such activities at least at their present level. The extent to which the practices and measures included in the recommended program may be carried out by the acceleration, intensification, or adaptation of certain activities under the current programs of Federal agencies in the watershed will be taken into account in requesting appropriations for the prosecution of the program.